

movie camera. The size is admittedly small, but the definition is excellent, and with the aid of an ordinary reading glass all necessary cloud detail can usually be seen. A diary was kept of exposure times, the general sky and weather conditions at the time of taking the picture, together with positive, actual-size pictures. The diary at the end of the year contained some 5,000 pictures of clouds. Some 600 of the best typical pictures have been enlarged to size 5 by 7 inches.

A few more details will now be given as to the camera and method of procedure:

The camera and lenses.—The camera used was a Zeiss Contax. At first a wide-angle lens was adopted, giving a field of view of about 90° (Zeiss Tessar 1: 8, f. 2.8 cm). However, when a filter was put on (a light yellow one), the wide angle at which the light met the filter caused much reflection, and as a result the outer parts of the picture very often showed serious underexposure. Hence an ordinary Zeiss Tessar (1: 2.8, f. 5 cm) was purchased and has proved very satisfactory in general.

The wide-angle lens was reserved for those pictures of clouds (e. g., large thunderstorms) which occupied too much area for the ordinary lens, but *no filter* was used with it. Usually the wide-angle lens, so used, gave sufficiently good results, but not always.

A light yellow filter was used with the ordinary lens, since trial with a dark yellow filter showed practically no improvement in detail. In fact, the Agfa Panchromatic films could almost be used without filter most of the time.

Films.—In the tropics, one cannot always get the film one desires, and we were compelled to start out with Superpan films. For the natural size small positives, this gave good results; but when enlargements to 5 by 7 inches are in question, or projection on a screen, then the grain of the Superpan becomes quite perceptible. Isopan films were used as soon as they arrived in Manila and these gave a smaller grain. Finally during the last month of work, the Finopan came, which for fineness of grain leaves really nothing to be desired.

Development.—Fine-grain developers of various types were tried, but they all proved unsatisfactory, due to lack of sufficient contrast in the negatives. Delicate cirrus clouds, or misty cloud effects, etc., would not come out properly; the fine details were lost, and many pictures, too many in fact, were quite flat. We therefore perforce had to use a contrast developer; but, alas, this also enlarged the grain. The grain, however, though at times not so pleasing to the eye on 5- by 7-inch enlargements, was not large enough to spoil details, and so for our films Eastman D-11 developer (time 5 minutes, starting at 16° C.) has been almost exclusively used. It was thought better to possess the requisite cloud details with a somewhat larger grain on enlargements

(of course on the small prints there is no trouble about grain), than to have smoothness with flatness and loss of detail. Perhaps in other climates, with clearer air, fine-grain developers would work better. The films in the tropics after development must be very thoroughly washed. Father Doucette, Chief, Meteorological Section of the Observatory, kindly did all the developing of the films, while the writer took the pictures and did all the printing and enlarging. In this way, though it took much time, the cost of the program was considerably reduced.

Printing.—For this, Eastman D-72 developer (home-made as was the D-11, by Father Doucette), diluted to proper proportions (1 part developer to 2 parts water) and Azo No. 5 or No. 3 paper, were used. *Very* thorough washing and the use of hypo *only once* were found necessary to prevent the prints from turning brown after some months.

Enlarging.—To have 5- by 7-inch enlargements made outside would have been very costly, and not so satisfactory, since it would be difficult for another to estimate rightly the proper shade of the clouds. It was found cheaper and much more satisfactory to make the enlargements ourselves, using a Zeiss "Magniphot." To get sufficient contrast on these enlargements, D-11 developer was again used, undiluted, and proved excellent when used in conjunction with News Bromide Contrast paper (or Medium for the more naturally contrasty pictures). With the new Finopan films, enlargements of this size, developed as indicated, give hardly any grain, and show exquisite detail and contrast.

Taking the pictures.—About 20 pictures a day were taken as a rule (the number varying with sky conditions), usually at intervals of 1 or 2 hours. An Ombrux exposure meter, which is reasonable in price and very satisfactory, was found an absolute necessity to gage exposures of clouds correctly. One had to learn, too, not to take pictures too near the sun or with too much contrast; this is especially true for pictures of squalls, storm clouds of various kinds, etc. The eye has a remarkable power of adaptation to varying degrees of light intensity, and only an exposure meter insures consistently good exposure times. This consistency is a necessity, for it must be remembered that the film roll has 36 pictures, and there can be no individual development, and this latter must be done in a tank in perfect darkness, since the films are so very sensitive to light. Even with a yellow filter, the ordinary exposure time used was one one-hundredth second, stop 8.

So much for the method. Now there remains the onerous task of studying the pictures in relation with the weather map. It will, in all probability, be a year or more before the results of such analysis can be published.

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SOLAR OBSERVATIONS

By IRVING F. HAND, Assistant in Solar Radiation Investigations

SOLAR RADIATION MEASUREMENTS DURING JUNE 1935

For a description of instruments employed and their exposures, the reader is referred to the January 1935 REVIEW, page 24.

Table 1 shows that solar radiation intensities averaged above normal at all three Weather Bureau stations.

With the exception of the western and southern stations, Fresno, Twin Falls, and Miami, table 2 shows an excess in the amount of total solar and sky radiation received on a horizontal surface. With the receipt of a new Eppley thermoelectric pyrheliometer, La Jolla again began regular measurements of total solar and sky radiation early in April. Values in gram-colories for the weeks beginning April 9, 1935, up to and inclusive of the week beginning with May 28, 1935, follow: 543, 525, 496, 620, 510, 553, 556, and 472 respectively. Beginning with this issue, these values will regularly appear in table 2.

Polarization measurements obtained on five days at Washington give a mean of 58 percent with a maximum of 60 percent on the 20th. At Madison, observations taken on five days give a mean of 62 percent with a maximum of 67 percent on the 7th. Both means are close to the respective normals for the stations for June,

but in both cases the maximums are slightly below the June normals.

TABLE 1.—*Solar radiation intensities during June 1935*

[Gram-colories per minute per square centimeter of normal surface]

WASHINGTON, D. C.

Date	Sun's zenith distance											
	8 a. m.	78.7°	75.7°	70.7°	60.0°	0 0°	60.0°	70.7°	75.7°	78.7°	Noon	
	75th mer. time	Air mass										Local mean solar time
		A. M.						P. M.				
		e	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	
	mm	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm	
June 1.....	7.19					1.36					5.79	
June 5.....	9.47	0.52	0.60	0.82	1.16	1.42					7.87	
June 6.....	10.59		.82	.96	1.12	1.40					8.81	
June 12.....	12.24					1.24					10.59	
June 13.....	15.11					1.32	1.06				9.47	
June 20.....	9.47		.87	1.04	1.23	31.41					9.83	
June 24.....	10.59		.71	.88							10.21	
June 25.....	10.59				1.11	1.41					9.14	
June 27.....	16.20				.87	1.16					15.65	
June 28.....	15.65				.82						13.13	
Means.....		.52	.75	.96	1.05	1.34	1.06					
Departures.....		-.05	+.08	+.18	+.11	-.10	-.12					